CLAIMS

1. A method (50) for monitoring a patient comprising:

determining (54) a first convex hull for a first plurality of points, each point of the first plurality of points having a first coordinate being a value of a first monitored signal at a specific moment in time, and having a second coordinate being a value of a second monitored signal at the specific moment in time;

determining (54) a second convex hull for a second plurality of points, each point of the second plurality of points having a first coordinate being a value of a third monitored signal at a specific moment in time, and having a second coordinate being a value of a fourth monitored signal at the specific moment in time;

monitoring (56) the first and second convex hulls to determine whether a perturbation has occurred in either of the first and second convex hulls;

determining (57), upon detecting a perturbation in one of the first and second convex hulls, whether a perturbation has occurred in the other of the first and second convex hulls; and

alerting (58) an operator that a clinically significant change may have occurred in the patient if both the first and second convex hulls have been perturbed.

2. A method (50) for monitoring a patient comprising:

determining (54) a plurality of convex hulls for a plurality of pairs of monitored signals from the patient; and

determining (56) whether a perturbation has occurred in one or more of the plurality of convex hulls.

3. The method (50) according to claim 2, further comprising:

alerting (58) an operator that a clinically significant change may have occurred in the patient if each of the plurality of convex hulls has been perturbed.

4. A method (50) for monitoring a patient comprising:

determining (54) a plurality of convex hulls for a plurality of pairs of monitored signals from the patient; and

indicating (58) a potentially clinically significant change based on a determination that a perturbation has occurred in each of the plurality of convex hulls.

5. The method (50) according to claim 4, further comprising:

determining (56) that a perturbation has occurred in one of the plurality of convex hulls; and

evaluating (57) one or more remaining ones of the plurality of convex hulls to determine whether a perturbation has occurred in each of the one or more remaining ones of the plurality of convex hulls.

6. The method (50) according to claim 5, further comprising:

upon determining (57) that a perturbation has occurred in the one or more remaining ones of the plurality of convex hulls, determining (58) that a clinically significant change may have occurred in the patient.

7. The method according to claim 5, further comprising:

upon determining (57) that a perturbation has not occurred in the one or more remaining ones of the plurality of convex hulls, determining (59) that an artifact may exist in the plurality of pairs of monitored signals.

8. A method (50) for monitoring a patient comprising:

indicating (58) that a clinically significant change may have occurred in the patient if perturbations exist in a plurality of convex hulls of a plurality of plots of monitored signal pairs; and

indicating (59) that an artifact may exist in one or more of a plurality of monitored signals if a perturbation exists only in a subset of the plurality of convex hulls of the plurality of plots of monitored signal pairs and not in a remaining ones of the plurality of convex hulls of the plurality of plots of monitored signal pairs.

9. An apparatus (120) for monitoring a patient comprising:

a plurality of leads (121), each receiving a monitored signal from the patient;

a memory (123) to store a value of each of the plurality of leads (121) at a plurality of points in time;

a processor (122) coupled to each of the plurality of leads (121), said processor (122) to determine a plurality of convex hulls for a plurality of pairs of signals from the plurality of leads (121), and to determine whether a perturbation has occurred in one or more of the plurality of convex hulls.

10. The apparatus (120) according to claim 9, further comprising a user interface (125) coupled to the memory (123) and the processor (122), wherein said processor (122)outputs an alert signal to the user interface (125) to indicate that a clinically significant change may have occurred in the patient if perturbations exist in a plurality of convex hulls of a plurality of plots of monitored signal pairs, or indicating that an artifact may exist in one or more of a plurality of monitored signals if a perturbation exists only in a subset of the plurality of convex hulls of the plurality of plots of monitored signal pairs and not in a remaining ones of the plurality of convex hulls of the plurality of plots of monitored signal pairs.

11. The apparatus (120) according to claim 9, further comprising a display (124) coupled to the processor (122) to display each of the plurality of signals from the plurality of leads (121) and to display a plurality of plots of each of the plurality of signals with respect to one of the other plurality of signals.

12. The apparatus (120) according to claim 11, wherein said display (124) overlays a calculated convex hull for each of the plurality of plots.

13. A computer readable media (123) having disposed thereon instructions causing a processor (122) to:

determine (54) a first convex hull for a first plurality of points, each point of the first plurality of points having a first coordinate being a value of a first monitored signal at a specific moment in time, and having a second coordinate being a value of a second monitored signal at the specific point in time;

determine (54) a second convex hull for a second plurality of points, each point of the second plurality of points having a first coordinate being a value of a third monitored signal at a specific moment in time, and having a second coordinate being a value of a fourth monitored signal at the specific point in time;

monitor (56) the first and second convex hulls to determine whether a perturbation has occurred in either of the first and second convex hulls;

determine (57), upon detecting a perturbation in one of the first and second convex hulls, whether a perturbation has occurred in the other of the first and second convex hulls; and

alert (58) an operator that a clinically significant change may have occurred in the patient if both the first and second convex hulls have been perturbed.

14. The computer readable media (123) according to claim 13, wherein the instructions further cause the processor (122) to:

determine (54) a plurality of convex hulls for a plurality of pairs of signals from the patient; and

determine (56) whether a perturbation has occurred in one or more of the plurality of convex hulls.

15. The computer readable media (123) according to claim 14, wherein said instructions further cause the processor (122) to:

alert (58) an operator that a clinically significant change may have occurred in the patient if each of the plurality of convex hulls has been perturbed.

16. A computer readable media (123) having encoded thereon a plurality of instructions for programming a processor (122) to monitor a patient, said plurality of instructions comprising:

determining (54) a plurality of convex hulls for a plurality of pairs of signals from the patient; and

indicating (58) a potentially clinically significant change based on a determination that a perturbation has occurred in each of the plurality of convex hulls.

17. The computer readable media (123) according to claim 16, wherein said instructions further comprise:

determining (56) that a perturbation has occurred in one of the plurality of convex hulls; and

evaluating (57) one or more remaining ones of the plurality of convex hulls to determine whether a perturbation has occurred in each of the one or more remaining ones of the plurality of convex hulls.

18. The computer readable media (123) according to claim 17, wherein said plurality of instructions further comprise:

upon determining (57) that a perturbation has occurred in the one or more remaining ones of the plurality of convex hulls, determining (58) that a clinically significant change may have occurred in the patient.

19. The computer readable media (123) according to claim 17, wherein said plurality of instructions further comprise:

upon determining (57) that a perturbation has not occurred in the one or more remaining ones of the plurality of convex hulls, determining (59) that an artifact may exist in the plurality of pairs of signals.

20. A computer readable media (123) having encoded thereon a plurality of instructions for programming a processor (122) to monitor a patient, said plurality of instructions comprising:

indicating (58) that a clinically significant change may have occurred in the patient if perturbations exist in a plurality of convex hulls of a plurality of plots of monitored signal pairs; and

indicating (59) that an artifact may exist in one or more of a plurality of monitored signals if a perturbation exists only in a subset of the plurality of convex hulls of the plurality of plots of monitored signal pairs and not in a remaining ones of the plurality of convex hulls of the plurality of plots of monitored signal pairs.